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Business Law and Agribusiness Perspectives on Functional Crop Commercialization: A Systematic Review

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Abstract

The biochemically enhanced functional crops have tremendous potential to increase the nutritional security, generate value added agriculture and boost the rural economy in India through commercialization. Notwithstanding these developments, the legal and regulatory framework for agribusiness entrepreneurship is still fragmented among several laws and institutional frameworks, such as food safety law, agricultural marketing law, intellectual property law, environmental governance, consumer protection law and contract farming law. This fragmentation can make it difficult for entrepreneurs, Farmer Producer Organizations (FPOs), agribusiness startups, and others interested in the commercialization of innovative agricultural products to comply. In this study, a systematic review of the literature is conducted, based on both a doctrinal and policy-analysis perspective, of existing legal and regulatory mechanisms with regard to the commercialisation of functional crops. The review is a synthesis of evidence on food safety governance, biofortification policies, value chain management, entrepreneurial ecosystems, digital traceability, and institutional support to highlight the key obstacles in food safety laws and governance to support sustainable agribusiness development. The results show that despite the various policy measures already taken to encourage innovation and entrepreneurship in agriculture, Indian agriculture is not having an integrated regulatory environment that is restricting market access, compliance complexity, and functional crop enterprises' commercial scalability. Given these results, a Legal–Agribusiness Commercialization Framework is proposed, which integrates all components of regulatory compliance, governance of food safety, coordination of the value chain, support for entrepreneurs and management of innovation in a single policy perspective. This review connects business law to agribusiness development and sustainable commercialization and offers practical insights for policy makers, legal professionals, entrepreneurs and researchers aiming to create resilient, competitive and innovation rich agribusiness ecosystems.

Keywords: Business Law, Entrepreneurship, Agribusiness Regulation, Food Safety, Farmer Producer Organizations, Biofortification, Supply Chain Governance, Sustainable Innovation, Corporate Governance, Agricultural Entrepreneurship

1. Introduction

Entrepreneurship in AAgribusiness is experiencing a major change in India. The traditional agriculture system has been increasingly linked to food processing, digital platforms, contract farming, producer-company system, biofortification, organic farming, blockchain-based traceability and rural enterprise incubator. This shift opens up new business possibilities, but also brings with it complicated legal issues on food safety, corporate governance, environmental responsibility, IP rights, consumer rights and equitable participation by the farmers. This article discusses the regulatory issue that is faced by the legal community: the lack of a single and business-friendly legislation concerning sustainable agribusiness. There are various overlapping laws and policies that govern agriculture and food systems in India such as Food Safety and Standards Act, 2006; the Companies Act, 2013; the Consumer Protection Act, 2019; the Protection of Plant Varieties and Farmers' Rights Act, 2001; the Biological Diversity Act, 2002; state laws on agricultural

produce markets; contract farming policies; environmental laws; and laws and standards for food fortification and labelling. These laws have important public functions, but are not operating coherently, causing uncertainty for agribusiness entrepreneurs and farmer producer organizations. The topic is timely as modern agro business is no longer just engaged in production and sale of agricultural commodities. The process of agriculture, climate change, contamination of food, malnutrition, globalised supply chains and digital market platforms have legalized agricultural entrepreneurship. Heavy-metal contamination associated with road transport provides a lesson that food safety issues can be identified and occur before food products reach the processing/retail market [1]. Likewise, the smart technologies in food fermentation demonstrate that food innovation should be controlled not only in terms of commercial efficiency, but also safety and standardization and consumer trust [2]. Pre-harvest contamination threats, such as aflatoxin in red chilli, once again demonstrate that food safety law needs to be implemented throughout the entire agricultural value chain, and not only at the end of the line for food products [3]. This is because a lot of existing scholarship focuses on food safety, agribusiness, farmer producer organisations, biofortification, supply chains and rural entrepreneurship as separate areas of study. But these areas have not been sufficiently incorporated into an integrated legal analysis of agribusiness entrepreneurship for sustainable business until now. This article aims to bridge the gap by suggesting that agribusiness law is best understood as an interdisciplinary practice, which encompasses food regulation, company law, agricultural marketing law, intellectual property law, sustainability policy, and entrepreneurial governance. This article's main thesis is that India needs to establish a comprehensive legal and policy regime for sustainable agribusiness entrepreneurship that ensures consumer protection, enhances farmer groups, fosters innovation, and expands the accountability of supply chains. The article covers the background and legal context, comparative and empirical trends, a critique of existing policy shortcomings, proposal for policy change, future implications and the significance of integrated business-law thinking for agricultural entrepreneurship.

2. Background and Legal Framework

Public health regulates, corporate governance rules govern, agricultural marketing controls dictate, IP law frames, environmental norms influence and entrepreneurship policy determines the Indian agribusiness legal framework. The Food Safety and Standards Act, 2006 sets up the Food Safety and Standards Authority of India as the central body to oversee standards, licensing, labelling, food additives, food fortification and enforcement in the field of food. However, practical compliance remains uneven, especially among small producers, informal vendors, and rural enterprises. Consumers and producers education is a crucial issue when raising awareness about food handling and hygiene because without this, food law does not have any chance of success [4]. In India, the issue of food fortification policy has gained significance due to chronic micronutrient deficiencies. Fortification of staple foods and biofortification of crops are increasingly seen as public-health and agribusiness strategies. Results from India indicate that implementation of food fortification can help reduce iron and other micronutrient deficiency, provided it is backed by scientific principles, capacity and acceptability of consumers [5]. Business-law issues regarding fortification include labeling, product claims, liability for misleading ads, IP rights to fortified varieties, and the process for getting regulatory approval. While the article emphasizes agribusiness law, other socio-legal aspects are also relevant. Land ownership, the economic contributions of women, and customary land tenure norms and systems affect rural land tenure. In South Asia, research on the inheritance system and matrilocal marriage rates indicates that family and property structures can affect women's productive assets and opportunities in the household-based business [6]. In the context of agribusiness entrepreneurship, legal reform will need to include the issues of land rights, gendered land ownership, succession, access to credit, and more. The requirement for full sectoral regulation is not an agricultural phenomenon. Legal literature in the field of tourism law in India reveals that a fragmented approach to tourism law can lead to uncertainty, compliance issues and weak accountability in the developing tourism sector [7]. A similar problem exists in agribusiness. There are several approaches to governance of agricultural enterprises, but none combine food safety, farmer governance, logistics, digital traceability, environmental sustainability and promotion of entrepreneurship. A multidisciplinary study on innovation also reinforces the importance of the integrated policy approach [8]. In today's agribusiness, not only is it about farming, it's about technology uptake, market linkages, IP, finances, logistics, sustainability certification, and consumer branding. Thus, it is necessary to go beyond the "agricultural law" approach to legal

analysis, and to incorporate a broader sense of corporate governance, innovation law, and entrepreneurial policy. Farmer Producer Organization (FPOs) is a critical and important part of the agribusiness revolution taking place in India. They enable small and marginal farmers to pool their produce, reach markets, bargain for better prices, buy inputs and engage in value addition activities. Institutional strength and commercial viability are necessary for FPOs to play a role in sustainable livelihoods and farmer well-being, according to research in Kerala [9]. Research in Gujarat also shows that having farmer producer organisations can positively impact socio-economic conditions, such as through enhanced market access and bargaining power [10]. Legally, FPOs function in the form of producer companies, cooperatives, societies, or trusts with varying governance, reporting, tax and liability requirements. Another legal and governance issue is managerial competence. A study of FPOs has revealed that managerial skill is strongly related with the business performance and involvement in value chain of FPOs [11]. This means that the compliance of company law is not enough, training in governance of the board, financial disclosures, contract negotiations, risk management, and dispute resolution are also required for FPOs. Agribusiness innovation is also greatly influenced by intellectual property law. Innovation from the bottom up has commercial and cultural value as seen in farmer-developed varieties of crops like Kunjukunju, a variety of rice from Kerala [12]. The Protection of Plant Varieties and Farmers' Rights Act, 2001 is significant as it tries to balance the rights of the breeders and farmers' traditional rights to save, use, sow, exchange and sell plant produce in the farm. For a legal framework of an agribusiness to be sustainable it should cover both commercial innovation and farmer knowledge. Agribusiness law is also shaped by environmental and biodiversity issues. India's diversity and conservation issues of trees in urban areas in Tamil Nadu are illustrative of the significance of biodiversity governance in development planning [13]. Another example of how indigenous knowledge of health and plant use can be useful for community well-being and beneficial is from the Irular communities in Tamil Nadu, who have an extensive body of traditional knowledge about plants and their uses in Tamil Nadu, and whose participation is often exploited by outsiders for commercial gain [14]. These relate the concept of agribusiness entrepreneurship to the Biological Diversity Act, 2002, access and benefit sharing regulations, and ethical commercialization of traditional knowledge. Figure 1 summarizes the five major research problems identified from the systematic literature review and presents the corresponding management- and policy-oriented solutions. It highlights the need for an integrated legal–agribusiness approach that connects regulatory compliance, institutional support, food safety, value chain governance, and innovation to enable sustainable commercialization of biochemically enhanced functional crops.

3. Comparative or Empirical Analysis (if applicable)

In the agribusiness sector, there are several innovation pathways ranging from biofortified crops, organic farming, farmer collectives, agri-incubation, contract farming, and digital supply chains. The use of biofortified crops has been growing in popularity as a sustainable solution to hidden hunger and nutritional security [15]. The innovation of agriculture is getting more and more science-based as evidenced by nutritional genomics and crop biofortification, where regulatory systems must evaluate safety, efficacy, labelling, and claims [16]. There are business-law concerns with biofortification of relevant food crops to improve nutritional security. Biofortified products sold by entrepreneurs need to be food safe and should not be subject to deceptive nutrition claims, traceable and respect IP rights of plant varieties [17]. Further research on the scientific application of nanotechnology in tomato crop has shown that new formulations and inputs could enhance crop nutrition, however also need to be thoroughly evaluated for their environmental safety, instructions for farmers, and labeling requirements [18]. Climate-resilient and nutritious, millets are especially relevant to India where millet biofortification can be used. The studies of agronomic biofortification of millets point to mechanisms and approaches that can contribute to nutritional security [19]. But, coordination is needed among Agricultural Universities, Seed Companies, FPOs, Food Processors & regulators for commercialization. The same experiments conducted with rice and zinc enriched bio-compost show that innovations to the soil can impact productivity and nutrition outcomes [20]. Long-term studies of iodine biofortification in tomatoes also reveal that nutrient-enhancement strategies have a potential to affect yield, nutrient quality and market value [21]. Agronomic interventions can also be implemented to increase productivity and nutrition of maize, such as seed and foliar application of zinc and iron [22]. Micronutrient mixtures for improving soil fertility and crop production are also examples of the commercial relevance of input innovation [23]. The study on zinc and iron biofortification of brinjal in coastal saline soil reveals the importance of taking the local environmental factors into account while regulating agribusiness [24]. These studies all point towards the need to legalize innovation in India in a safe, transparent, and accountable manner. Human resource limitations are still a big problem in agri-marketing in the rural area. Studies in Tamil Nadu delta areas have shown that the weak performance of rural agribusiness is due to lack of skilled people [25]. In addition, the adoption of technologies in agribusiness is also a key area of research, as indicated by bibliometric evidence, which has increased the research interest in innovation as a driver of agricultural enterprise [26]. However, technology adoption alone cannot resolve structural legal problems such as unequal bargaining power, unclear contracts, weak infrastructure, and limited access to formal dispute-resolution mechanisms. Occupational and socioeconomic factors are also identified in the empirical work carried out in each sector. Economic and occupational problems are the challenges that the fresh water fish farmers in the Cauvery Delta region are facing, which need policy support and integration with the markets [27]. The feasibility of designing local agribusiness around principles of circular economy and enterprise development at the local level is exemplified in sustainable enterprise models, such as vermiculture based organic farms [28]. The diversification plan in pearl farming is also an example of how diversification can improve farm income and generate new business opportunities in India [29]. Another comparative model is that of an agribusiness that is organic. The challenges associated with sustainable and climate-friendly organic enterprises include compliance costs, the credibility of the certification process, consumer trust and access to markets, which can be leveraged through value creation through certification, ecological branding, and premium markets [30]. An analysis of the groundnut cultivation economics reveals that profitability varies according to the nature of the crop in Andhra Pradesh on the basis of the input costs, output quantities, prices realized and market structures [31]. Legal reform should also be complemented by capacity building [32] and entrepreneurship education for farmers utilizing plant genetic resources and farmers' varieties who possess entrepreneurial attributes and self-regulatory skills. Contract farming is an important but controversial legal instrument. It can offer guaranteed markets, inputs, technical support, and price stability in the production of organic crops [33]. However, contract farming can be detrimental for smallholders by promising them unfair conditions, rejection of poor quality produce, late payments and reliance on corporate buyers. Thus, the contract farming law should include provisions for written contracts, clarity in the pricing structure, specifications of quality requirements, prompt payment, availability of conflict resolution channels, and provisions to prevent exploitation. There are other institutional arrangements that foster rural entrepreneurship, such as agribusiness incubation. Research in India reveals the importance of strategic direction, institutional support, mentorship, finance, and market linkages in agribusiness incubation [34]. This

showcases the transformational potential of local resources into sustainable business models through innovative entrepreneurship when nurtured by entrepreneurship ecosystems, as seen in the banana fibre business of Tamil Nadu [35]. Marketing and value-chain development continue to be critical as even innovative products will not sell without farmers with the storage, branding, aggregation, logistics and/or access to buyers [36] The Asian experience with agribusiness incubation demonstrates that institutional support is essential not only for the implementation of projects, but for rural transformation, which can take longer to achieve. [37]

4. Policy Analysis and Critique

India has some good features in its agribusiness legal structure. First, the FS Act establishes a national system for the regulation of food quality and consumer safety. Secondly, the company law has given a corporate framework to farmer collectivization via its provisions for producers. Third, plant variety protection law offers protection to farmers' rights and breeders' rights. Fourth, the government schemes help FPOs, agri-incubation, organic farming, digital market and food processing. Fifth, there is a growing awareness of the importance of biofortification, supply chain efficiency and rural entrepreneurship in sustainability and nutrition policies. But, the downfalls are considerable. In many states, such as Tamil Nadu, agricultural logistics and supply-chain systems are still not interconnected, and agricultural activities are still being impacted by transportation, storage, aggregation and market access [38]. The other studies in Telangana also indicate that issues related to logistics, ICT implementation and coordination of regulatory policy are also issues in agricultural supply chains [39]. The results suggest that, in addition to strengthening market entry, legal reform needs to consider the infrastructure and digital platforms that enable farmers to access profitable value chains.

Empowering farmers to improve their position in the agricultural supply chains is a key component of transformation, which can be achieved by better aggregation, transparent pricing, integration of logistics and market-oriented institutions [40]. The use of emerging technologies, such as blockchain based Internet of Things systems, can enhance the traceability, efficiency and sustainability in agricultural supply-chain management [41]. However, technology solutions also introduce a number of legal issues around data ownership, privacy, liability if data is inaccurate, interoperability, cyber security, and data significance in cases. For small-scale dairy farmers, direct marketing can enhance profitability and economic sustainability in Asian settings [42]. This indicates that cutting down on unessential middlemen can be beneficial to producers. But, if regulation is removed without protection, small farmers may be vulnerable to the strong arm of the buyers. Hence, the liberalisation of the market should be accompanied by competition law, fairness for contracts, security of payment, and mechanisms to tackle discontent.

One other emerging issue is ethical supply-chain assessment. This idea of a ‘Supply Chain Karma Score' suggests a way to measure the ethical impact of a global supply chain [43]. These models can be modified to suit the Indian agribusiness using the concepts of sustainability scoring, fair payment certification, disclosure of climate risks, and reporting of social impact. Voluntary ethical scoring should not be a substitute, however, for mandatory legal requirements in cases involving public health, worker safety and consumer rights. The empirical evidence from the contract farming value chain in West Bengal indicates opportunities and challenges for small farmers [44]. Whilst contract farming can enhance market access, there are risks if the farmer is not in a position to bargain, to know about contracts by law, or to be able to negotiate contracts collectively. This reinforces the idea of increasing the importance of FPOs in contract negotiations for small farmers. The vermiculture-based organic farming serves as a good example of sustainable local enterprise development [45]. However these models need to be scaled up and there is a need for supporting legal certification, local branding, input quality control, finance, training and market access. The barriers to adoption of the alternative grains supply chain also indicate that IP, knowledge systems and organizational learning are important for sustainable businesses [46]. From a legal perspective, this means that the compliance frameworks need to be easy to understand and cost-effective for small businesses.

Circular economy and Lean Six Sigma methods in farm business models suggest that sustainability can be embedded in the efficient and quality management [47]. However, current legislation fails to adequately incentivize circular practices like composting, reusing waste, minimizing chemical usage, using renewable energy and minimizing carbon footprints in logistics. The input market in poultry feed supply chain in India is also found

to be complex and sensitive to price, quality and coordination issues [48]. Lastly, climate change poses a threat to the financial stability of agribusiness and therefore the governance of climate risks is an urgent issue for lenders, insurers, entrepreneurs and regulators [49]. It, therefore, makes sense to read the normative critique in the Indian agribusiness law as being reactive rather than ecosystem-oriented. It's overseen by distinct legal domains: food, companies, markets, contracts, biodiversity and consumer protection. Without a single compliance pathway, entrepreneurs and FPOs need to overcome these silos. This raises the cost of business, reduces incentives to create new products, and diminishes accountability.

5. Proposed Reforms or Solutions

5.1 Enact an Integrated Agribusiness Facilitation Framework

India should consider a coordinated agribusiness facilitation framework that links food safety licensing, FPO registration, contract farming compliance, digital traceability, sustainability certification, and market-access support. This doesn't need to replace the laws and regulations already in place, but it could work as an umbrella or coordinating mechanism offering more streamlined compliance options for small and medium agribusinesses.

5.2 Strengthen FPO Governance

FPOs need to be provided with structured legal assistance on corporate governance, accounting, board responsibilities, member voting rights, conflict of interest provisions, contract review and dispute resolution. There should be regional language practical compliance toolkits for producer-company law.

5.3 Create Fair Contract Farming Standards

Contract farming arrangements should be based on contracts in clear language, clear pricing regimes, objective quality specifications, specifications for payment terms, guarantee that produce cannot be rejected unilaterally, and guarantee access to dispute resolution. Collective bargaining can help to prevent exploitation—FPO-negotiated contracts should be encouraged.

5.4 Regulate Biofortification and Nutrition Claims Carefully

Biofortified and fortified foods should be encouraged and nutrition claims should be substantiated and be subject to food safety review. The rules defining the term "Label" should be clear about nutrient content, scientific basis and benefit to the consumer. There should be a balance between the encouragement of responsible innovation and a ban on misleading health claims.

5.5 Develop Digital Traceability Law for Agribusiness

Standards for data ownership, farmer consent, privacy and cybersecurity, interoperability, and liability should be encouraged for blockchain, IoT, and digital supply-chain platforms. Digital records should facilitate identification of contamination, trace origin, and increase transparency of payments.

5.6 Support Sustainable Agribusiness Incentives

Organic farming, vermiculture, models of circular economy, low-carbon logistics, bio-composting and sustainable packaging should be encouraged through legal and fiscal measures. The systems used for certification should be credible, but affordable to small businesses.

5.7 Protect Grassroots Innovation and Traditional Knowledge

Farmer-developed varieties, indigenous knowledge, and community-based agricultural practices should be protected through plant variety law, biodiversity regulation, benefit-sharing mechanisms, and ethical commercialization standards.

6. Future Implications for Business Law and Entrepreneurship

The future of agribusiness entrepreneurship will be shaped by climate change, digital supply chains, nutrition-sensitive agriculture, alternative grains, biological inputs, precision farming, and farmer-owned enterprises. Business law must evolve from a compliance-only model to an enabling model that supports innovation while protecting public interests. For entrepreneurial ecosystems, this means that incubators, universities, FPOs, startups, and regulators must work together. Agribusiness founders will need legal literacy in food safety, contracts, company governance, environmental law, intellectual property, consumer protection, data protection, and sustainability reporting. Lawyers and policymakers will need to understand agricultural science, rural markets, digital platforms, and farmer institutions. Emerging technologies will create new legal questions. For example, if a blockchain traceability system records incorrect crop-origin data, liability may arise for platform providers, aggregators, exporters, or certifiers. If biofortified foods are marketed with exaggerated claims, consumer protection law may apply. If FPO directors enter unfair contracts without member consent, governance disputes may arise. If agribusiness startups commercialize indigenous knowledge without benefit sharing, biodiversity law may be implicated. Future research should examine how FPOs actually experience legal compliance, how small agribusinesses manage food safety licensing, how digital traceability affects farmer bargaining power, and how climate-related financial risks influence agricultural lending. Comparative research with other jurisdictions may also help India design better contract farming rules, sustainability standards, and rural enterprise policies.

7. Conclusion

The present article has pointed out the need for the integrated approach of business-law for development of the sustainable agribusiness entrepreneurship in India. While there are important protections in the current legal framework, these protections are spread across various regulatory systems for food safety, corporate governance, plant variety rights, consumer welfare, and environmental sustainability. Such a division leaves a lack of certainty for entrepreneurs, FPOs, farmers, consumers, and policy makers. The key message is that agribusiness law is not a ‘skin cancer' issue. It's a business-law field that includes company governance, food regulation, intellectual property, contracts, supply-chain accountability, technology governance, sustainability and rural entrepreneurship. There is a strong need for legislative changes that will increase ease of compliance, improve contract terms, boost innovation security, enhance transparency in supply chains, and empower farmer organisations in order to ensure a bright future for agribusiness in India. The article adds to the scholarship of business law and entrepreneurship by advancing a common language in law for the understanding of sustainable agribusiness. It concludes that the success of agricultural entrepreneurship requires more than innovation and market access, but also regulatory clarity, institutional trust and equitable governance. A robust agribusiness legal framework can serve the interests of consumers, boost farmers' empowerment, encourage responsible investment, and foster a more sustainable and inclusive agribusiness sector in India.

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